Asia Pacific Education Review
2007, Vol. 8, No.2, 205-215.

Development of a Scale to Measure Economic Status of Students in Rural Vietnam

Nguyen Thi Kim Cuc **Patrick Griffin**
The University of Melbourne
Australia

Family economic status is generally considered to be an important factor associated with students' educational outcomes. However, to evaluate the strength of this contention, it is important to first have appropriate measures of family economic status. Measuring the economic status of Vietnamese people has been particularly difficult as the respondents have not been able to report accurately on their income. This has been compounded in rural populations, because of the relative economic homogeneity of communities. This study constructed, calibrated and validated a set of items to form a measure of economic status of students' families in rural Vietnam.

Key words: Construct, economic status, Rasch modelling, Vietnam

Background

Economic status is a theoretical concept that is not directly measurable (Bollen, Glanville, & Stecklov, 2001, 2002). Traditionally, income and expenditure over a specific time period were often used as proxy measures of economic status. However, Friedman's (1957) conceptualisation of economic status as both permanent income and transitory income has led to a rejection of the use of current annual income or expenditure as misleading, especially in situation where incomes fluctuate. Behrman and Deolailikar (1990) proposed an alternative approach to overcome this deficiency by measuring average income over several years. For many situations, however, this longitudinal approach is prohibitively expensive and time-consuming. In general, expenditures or consumption are considered to be less variable measures than income and more reflective of economic status across the longer term. Thus, annual household expenditures or consumption may provide a useful proxy of permanent economic status (Deaton, 1992 cited in Bollen et al., 2001, 2002; Friedman, 1957).

In developing countries, income data are often inaccurate, unreliable and difficult to gather (Hentschel & Lanjouw, 1996; Montgomery, Gragnolati, Burke, & Paredes, 2000). Expenditure measures appear to have advantages over income measures, as the former are considered more straightforward and reliable. However, the accurate measurement of consumption expenditure is also a costly undertaking (Montgomery et al., 2000) and not necessarily reliable (Nguyen & Griffin, 2004). Rather than employing the conventional methods of measuring households' economic status through income or consumption expenditures, an alternative way of measuring family economic status may be through surveys of household ownership of consumer goods. This strategy was proposed and employed in international projects such as the Demographic and Health Surveys (DHS) (Filmer & Pritchett, 1998a, 1998b, 1999, 2001), the United Nations Children's Fund (UNICEF) Multiple Indicator Cluster Surveys (MICS) (UNICEF, 2004), and Primary School Monitoring (Griffin & Tran, 2000). The use of information about household consumer durables was supported by Bollen et al. (2002) as an appropriate and highly

Nguyen Thi Kim Cuc and Patrick Griffin, Assessment Research Centre, The University of Melbourne, Australia.

Correspondence concerning this article should be addressed to Nguyen, Thi Kim Cuc, Research Fellow, Assessment Research Centre, Faculty of Education, The University of Melbourne, Room G.13, Ground Floor, 234, Queensberry Street, Carlton VIC 3053, Australia. e-mail: cuc@unimelb.edu.au

recommended method. Further, Bollen et al. (2002) demonstrated that, among many methods of proxying for economic status, two were most common: a sum of the goods owned by the household and a principal components score (Filmer & Pritchett, 1998a). However, these two methods did not facilitate the interpretation of the targeted variable of "economic status". Nor did they indicate how well an index of economic status distinguishes between sub groups in a population. This article addresses these challenges by constructing and calibrating a proxy for the economic status of families in rural Vietnam using item response modelling.

The Measurement Model

Rasch (1960) proposed a logistic response model with one item parameter and one person parameter. The approach requires that we define in advance what it is that we are measuring, that there are units of measurement, and that we can link the probability of obtaining a specific answer to a specific item to a persons' ability in the domain we are measuring. There are several things that are prerequisite in this. The domain of interest or the target for the attitude measurement needs to be operationalised. To achieve this, tasks or items are required that can be ordered in terms of the amount of attitude or opinion they demand in order to agree with the substance of the item. When a scale is put forward to measure economic status, for instance, the variable (economic status) is defined and items that are indicators of economic status are hypothesised to be located at different levels on the variable.

The location and interpretation of the levels on the variable represent the contribution of an item response model analysis over other forms of empirical calibration. Rasch analysis assists in constructing a variable from a dominant dimension in the data. Using factor analysis with the original data can lead to misleading results as they can generate illusory factors (Wright, 1996). Linacre (1998) also argued that exploratory factor analysis can report items clustering at different performance levels as different factors and that there is no way of knowing from factor analysis alone whether each factor is a dimension or a slice of a shared dimension. Factor loadings are correlations of existing data with a latent vector constructed to minimise residuals, but the loadings are not on a linear metric. They are constricted between -1 and +1 and any plots they may be cast in are coordinates rather than maps of a variable. No approach to factor analysis provides measures of location on the variable and this prohibits the interpretation of levels of economic status. Griffin (2005) compared confirmatory factor analysis and item response modelling (IRM) and showed that while these were statistically and mathematically equivalent, the advantage of being able to define the construct from item locations on the variable instead of correlations with the underlying trait swung the balance of favour for the analysis strategy in favour of IRM Griffin's method (Griffin, 2005) used only dichotomously scored items. In this study the quality of the items is included to allow for within item differentiation of value as an indicator of wealth.

Development of a Economic Status Index in Rural Vietnam

It is difficult to measure the economic status of Vietnamese people. For example, a survey on status and causes of illiteracy among women and girls in Vietnam showed that respondents tended to give inaccurate answers to questions about their income (Research Centre for Complementary Education, 1992). In many cases the respondents simply did not report accurately on their incomes. Tran (1994) tried to identify students' family economic levels by asking parents about their perception of their own "economic level". The study classified economic level into four categories: excessive, sufficient, a lack of food and the number of months that the family suffered from a lack of food. However, categories such as "lack of food" and "the number of months that the family suffered from lack of food" proved to be problematic because the approach seemed to focus on poverty rather than economic status. In addition, it appeared not to make a distinction among the population in towns or urban areas, where the problems of a lack of food were not so severe. Moreover, because the measurement used only a single item, the reliability of the measurement could not be estimated.

Griffin and Tran (2000) were the first researchers who proposed an alternative approach to identifying the economic status of students' families: measuring a *possessions index* or the living standards of students' families. Students involved in the World Bank Project *Primary School Monitoring* were presented with a checklist of 26 items they could potentially possess in their home, and asked to respond that they either did or did not have each item at home. The students' responses to the possession checklist were then calibrated using item response (or Rasch) modelling. The scale formed from this analysis was based on the probability that a student would possess the item. Thus, a measure of the likelihood of the items being possessed, and of families owning the items, provided an implicational scale of the living standards of

students (Griffin & Tran, 2000).

The extent to which this prediction succeeded is a measure of the fit of the model to the data. As the fit statistics indicate the extent to which responses to an item are in agreement with responses to other items, they were used to assess uni-dimensionality. Fit statistics are standardised mean square differences between observed and expected or predicted values (Wright & Masters, 1982). They have an expected value of 1.0 and, as a rule of thumb, an accepted range of values between 0.77 and 1.30 (Adams & Khoo, 1996). The findings suggested that cultural and regional patterns of owning and using items were very important aspects to be considered when developing a set of items measuring a economic status index in Vietnam. Items that mis-fitted the probabilistic model were removed from the analysis, and a 22-item scale that differentiated well between socio-economic groups in Vietnam was developed. For example, people in the city do not own a boat (a mis-fitting item) not because they could not afford one, but because they did not have any need to own one.

The method of constructing an index using Rasch modelling employed by Griffin and Tran (2000) has advantages over a principal components analysis as used by Bollen et al. (2001) and Filmer and Pritchett (1998a, 1998b, 1999, 2001) and confirmatory factor analysis (Griffin, 2005). Item response theory (IRT) approaches can deal with the data that violate the strict assumptions of factor analysis and resolve issues that confirmatory and structural equation approaches cannot. IRT enables the determination of both item and person fit. It can deal with non-continuous data and allows an examination of differential item functioning (DIF) to examine bias and inconsistent item behaviour over sub samples (Hambleton, Swaminathan, & Rogers, 1991). An item shows DIF if individuals having the same economic staus, but from different groups, do not have the same probability of possessing the item. The current study extends Griffin (2005) and Griffin and Tran's (2000) work by including an indicator of intra item affordability to the list of household possessions. This is argued to provide a more discriminating measure of economic status because of variation in the cost of specific goods even within a single country. For example, a motorbike made in Japan might be ten times more expensive than one made in China. To simply enquire about the family's ownership of a "motorbike" without taking item purchase price into account can be somewhat misleading. Thus, the presence of items in the household is an important indicator of wealth, but the relative cost of those items also contributes to an understanding of economic differences between households.

Constructing a "Economic status" Index

Identifying the Variable

To construct a variable using Rasch modelling, the first step was to "mark out the variable along which measures are to be made" (Wright & Masters, 1982, p. 91) as "the very idea of measurement implies a linear continuum of some sort such as length, price, volume, weight, age" (Thurstone & Chave, 1929, p. 11 cited in Wright, 1997, p. 38). Accordingly, the first stage in the process of developing a measure of economic status was to construct a hypothesis of the continuum that was measurable and had direction and levels of magnitude (Corcoran, McKenna, McDonnald, Griffin, & Pitman, 1996). This preliminary definition of the variable is

Table 1
Intended Scale to Measure Economic Status Index

Level	Content
4 (highest)	These families own a wide range of luxury items such as video, refrigerator and telephone. Many items owned are of high quality (expensive) and the family typically live in a two or three level house.
3	These families own most items necessary for a comfortable life. Some items are of high quality (expensive) and people tend to live in flat roof houses.
2	These families have enough food; they tend to have better quality meals (e.g., with meats and fish). They tend to own a range of necessary items that are not of high quality (inexpensive) and have new clothes every year. They tend to live in tile roof houses.
1	These families lack food and their meals tend to be of low quality (no meats or fish). They are likely to own very simple, basic and inexpensive items such as a thermos and clock. They tend to live in straw houses or tile roof houses.

sometimes referred to as the qualitative dimension underpinning each of the variables measured. The hypothesized scale of economic status was adopted from Griffin and Tran's (2000) study but modified to suit a rural context. It was intended to cover four hypothesised levels of economic status as presented in Table 1. This definition of the continuum guided the process of designing the items to measure economic status.

Item Development and Piloting

Following the identification of the hypothesised economic status index, the next step was to design a cohesive set of indicators for the variable (Wright & Masters, 1982).

Table 2
Item Content and Categories of the Items Measuring Economic Status

Items	Questions	Categories	Code
1 (Clothes)	How many sets of new clothes	None	0
	do you buy a year?	One set	1
		Two sets	2
		Three sets or more	3
2 (Meal)	How many good meals (with fish, meat	None	0
	or eggs) did you have a week?	One or two	1
		Three or four	2
		Every day	3
3 (Lack of	How often did your family suffer	Never	2
Food)	from lack of food in the past year	Sometimes	1
		Several months a year	0
4 Cupboard	Does your family have the	Do not have	0
5 Motorbike	following items?	Have normal one	1
6 Bicycle		Have expensive one	2
7 Colour TV			
8 Video			
9 Ceiling fan			
10 Stand fan			
11 Wall clock			
12 Lounge suite			
13 Refrigerator			
14 Thermos			
15 Telephone			
16 (House)	What type of house do you live in	Straw house	0
		Tile roof house	1
		One level flat roof house	2
		Private-multi-storey house	3

Items were adapted from Griffin and Tran's (2000) study. The questionnaire was first piloted with a small number of lower secondary students in the Lang Giang district of the Bac Giang province, and then modified before being administered to a small sample of students from the district of Luc Ngan, Bac Giang province. This process is to ensure that there were no confusing words, phrasing or formatting. It was not an empirical study of the scale, but an initial exploratory investigation of the wording and usefulness of the items. The next step was the estimation of threshold locations for the items and the fit indices in an evaluation of the instrument. The estimation processes were performed using the software QUEST (Adams & Khoo, 1996). As a result, the set of 16 items as presented in Table 2 were included in the final questionnaire. All items in Table 2 were responded to using a series of "ordered categories". The questions addressing family economic status were presented to 602 students from various ethnic backgrounds in secondary school in Thanh Hai and Quy Son schools, Luc Ngan district, Bac Giang province (Nguyen, 2002; Nguyen & Griffin, 2004).

Calibration

One of the important steps in evaluating the validity of the instrument was to examine whether the items worked together to define a single variable. The responses to each item were examined for their consistency in fitting a single variable along which persons had a unique order (Wright & Masters, 1982). Where the responses to an item were not in general agreement with the ordering of persons implied by the majority of people, the validity of the item was regarded as suspect. If some items did not fit the model, they were considered for rejection or modification. Mean square differences (residuals) between predicted (or modelled) and observed response values were used as effective measures to consider the compatibility of the model with the data. When these mean squared residuals are weighted for item variance they are called an infit mean square. As a general rule, an item belongs to a constructed set of items if its infit mean square (INFIT) lies within the range from 0.77 to 1.30 (Adams & Khoo, 1996; Linacre & Wright, 1994).

For example, the item "bicycle" behaved as follows: people who owned an inexpensive bicycle were at the lower

Table 3
Item Parameter Estimates-Affordability, Measurement Error and Infit

	Item	Threshold $_1$	SE_1	Threshold $_2$	SE_2	Threshold $_3$	SE_3	INFIT
1	Clothes	-6.63	0.47	-1.54	0.2	1.74	0.24	1.13
2	Meal	-5.34	0.34	-1.28	0.19	0.82	0.18	1.05
3	Lack of food	-3.72	0.25	-1.54	0.18			1.12
4	Cupboard	-3.00	0.25	2.8	0.33			0.96
5	Motorbike	-0.56	0.19	1.21	0.21			0.9
6	Colour TV	-2.03	0.19	1.14	0.24			0.92
7	Video	0.53	0.22	2.66	0.35			0.87
8	Ceiling fan	-0.13	0.19	3.02	0.36			0.98
9	Stand fan	-3.88	0.28	3.18	0.39			1.13
10	Wall clock	-4.22	0.31	3.18	0.4			0.90
11	Lounge suite	-1.06	0.19	3.54	0.44			0.94
12	Refrigerator	2.03	0.42	2.64	0.47			0.98
13	Thermos	-6.94	0.69	3.39	0.55			0.92
14	Telephone	2.75	0.56	4.68	1.27			1.14
15	House	-4.97	0.28	0.63	0.23	1.95	0.30	1.07

end of the scale and people who owned an expensive bicycle were at the top of the scale. While the item fitted the model (infit mean square is 0.88), 99.3% reported that their families owned a bicycle but only six students (1%) reported having an expensive bicycle. This item did not separate people in terms of their possession status very effectively, and therefore was removed from the set of items measuring economic status. The removal of this item improved the item reliability separation index from 0.94 to 0.95. Such a high separation reliability index idicates that the items would behave consistently across similar samples.

The availability of cheap motorbikes made in China has led to a situation in which Vietnamese people are more likely to purchase a motorbike than an expensive bicycle. The number of motorbikes registered in Vietnam was 8, 400, 000 by 2001, which was almost eight times the number of motorbikes in Vietnam in the early 1990s (Giao Thong Van Tai newspaper, November 1, 2001). The preference and tendency of Vietnamese people to purchase motorbikes instead of expensive bicycles explains why most of the families owned bicycles but the quality of bicycle was of lesser concern. Table 3 presents the calibration statistics for the economic status scale after removing the "bicycle" item.

The first column in Table 3 indicates the item name. In the next columns, Threshold *i* and standard error, SE_i (i=1,2,3) are parameters of item thresholds and their standard measurement errors. The last column, INFIT, reports the infit mean square. These are the mean squared differences between the estimated or modelled threshold affordability of the item and the observed affordability associated with each ordered category, weighted by the variance of the assigned scores. It can be noted from Table 3 that the INFIT values are all within the acceptable range of 0.77 to 1.3 and hence there is evidence of a single underlying continuum in the variable Economic status being measured.

The computer program, QUEST, also provided a summary of item and case fit statistics. In most instance, the fit of the item set to the model is expressed by the infit mean square and outfit mean square. The item and person infit mean square and outfit mean square are the weighted and unweighted residual-based statistics (Adams & Khoo, 1996; Wright & Masters, 1982). If the data fit the model, the infit mean square and the outfit mean square should have a mean near one (Adams & Khoo, 1996). These statistics are displayed in Table 4.

The second column of Table 4 (item estimates) presents the infit and outfit mean square statistics of items, while the third column shows case estimates, infit and outfit mean square statistics of people in the sample. For each of the columns, the mean and standard deviation (SD) of item estimates and case estimates are presented respectively. It is noted from Table 4 that the mean infit mean square of both item and case estimates were equal to the expected value of 1.0. However, the outfit mean squares of both items and case estimates were larger than the expected mean indicating that there may be some outliers in the response patterns (Adams & Khoo, 1996; Wright & Masters, 1982).

Table 4
Summary of Fit Statistics and Estimates Separation Reliability of the Scale of Economic status

	Item Estimates	Case Estimates
Infit Mean Square		
Mean	1.00	1.00
SD	0.10	0.61
Outfit Mean Square		
Mean	1.14	1.13
SD	0.44	3.88
Reliability Estimates		
Mean	0.00	-1.11
SD	1.80	1.65
Separation Reliability	0.95	0.86

Separation Reliability Indices of Economic Status Estimates

Wright and Masters (1982) have also pointed out that there is a need to provide evidence of a discernible line of increasing intensity. The reliability of item separation demonstrates the extent to which the items or score points in a scale are separated and define a direction and meaning for a variable. Item separation reliability allows "the proportion of observed item variance which is not due to estimation error as the reliability with which this sample separates these items" (Wright & Masters, 1982 p. 92). An item separation reliability index of zero would indicate that the items are not separated, or in other words, that the errors of measurement are so large that all estimates of persons and items overlap. An item separation index of 1.0 would indicate a complete separation along the variable designed, or alternatively that the measurement errors are so small that there is no overlap between the estimates.

As the purpose of constructing variables is to "measure"

attributes of the objects under consideration, a primary question is: "have we succeeded in separating persons along the variable?" The reliability of person separation indicates how well a sub-set of items separates the persons in a particular sample. Person separation reliability allows us to report the percentage of observed variance among students in the sample, which was not due to the mean square measurement error, and the reliability with which these items separate these families. Similar to the item separation index described earlier, a case separation reliability index of zero would indicate that the persons within the sample are not separated, or that the errors of measurement are so large that all estimates of persons and items overlap. A case separation index of 1.0 would indicate a complete separation along the variable designed, or that the measurement errors are so small that there is no overlap between the estimates.

Summarised item and case separation reliability estimates of the economic status scale are presented in the section titled "Reliability Estimates" in Table 4. The mean item affordability was arbitrarily set to be zero while the mean economic status was -1.11. The variance of item affordability levels was 1.8 and the variance of economic status estimates was 1.65. The fact that these two means were separated by approximately one logit indicates that the set of designed items were relatively well matched to the range of economic status. The item and case separation reliabilities of the variable economic status were high: 0.95 and 0.86 respectively. This means that the items were well separated on the variable and lends support to the construct validity of the scale (Bond & Fox, 2001; Wright & Masters, 1982). Similarly, the scale appeared to differentiate between families' overall basic possessions (Bond & Fox, 2001; Wright & Masters, 1982). The high reliability also supported the contention that similar relative item difficulties would be obtained with similar samples. In brief, the items of the designed scale were well separated and appeared to differentiate wealth levels of students' families.

Variable Interpretation or Description of the Economic Status of Students

It was also important to examine the item category placement along the variable line. A content analysis of item clusters located along the scale supported the construct validity of the designed variable. This step represents qualitative analysis of the items and analysis interpretation of the variable (Griffin, 1997, 2004; Nguyen & Griffin, 2003, 2004). Figure 1 presents the graphic display of the analysis. On the left of the map is the scale ranging from –8.0 to +5.0. This is the logit scale, a measure of the relative stringency of each item. The variable map also represents the estimates of economic status levels with each family represented by an x, and the affordability of the item category, represented by x.y notation on the right of the map. In the x.y notation, the x represents the item number and y represents the score obtained. For example 14.2 represents a score of 2 on item 14 or in other words, students selected category 2 on item 14 indicating that they owned an expensive telephone.

Descriptions presented on the right of the map in Figure 1 are from the content analysis of the possession status scale. Figure 1 indicates that score categories of 15 items formed several clusters that exhibited different levels along the continuum economic status. Analysis of the relative positions and contents of the item clusters suggested five levels of wealth.

The lowest band includes 2% of the students in the sample. This band refers to the students whose families were identified as "poor". They typically could only afford one or two good meals a week, and one set of new clothes each year. They own simple and very basic possessions, such as a thermos.

The second lowest band includes 24.5% of students. This band was labelled "shortage" and students belonging to this band were those whose families did not always have enough food, but possessed basic sleeping and daytime furniture. In addition to those possessions owned by families in the first band, families in the second band typically could afford to own a wall clock, a stand fan, and a cupboard but not a TV.

The middle band referred to families who could afford a TV and never lacked for food. They typically had three or four good meals (with meat or fish) a week and owned a normal lounge suite. However, they were unable to afford a motorbike. This band, thus, was labelled as "basic need". About 22.5% of the students in the sample belonged to this band.

The second highest band included 41.5% of the students' families. It was labelled as "comfortable". Families of this band typically owned a motorbike. Fifteen percent of the families in this band also had a basic video player.

The highest band included 9.5% of students in the sample. This band was labelled "wealthy". All families in this band typically owned a flat roof house, and always had good food. Many owned an expensive motorbike and TV. Some families of students located at the top of this band also owned a multi-storied house and a refrigerator.

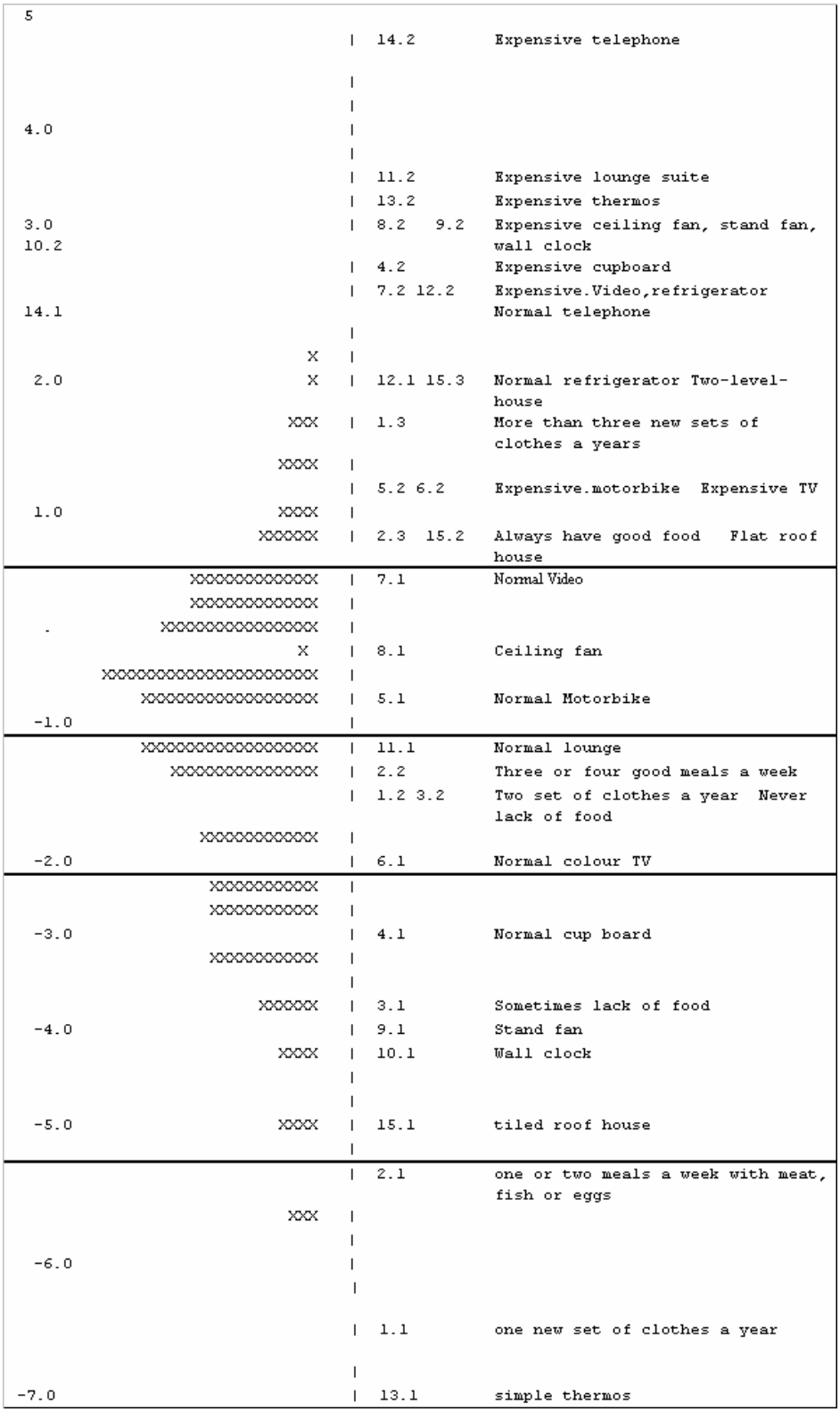

Figure 1. Variable map of economic status

Table 5
Comparisons of the Hypothesised And Derived Constructs

Original Construct	Derived Construct
These families own a wide range of luxury items such as video, refrigerator and telephone. Many items owned are of high quality (expensive) and the family typically lives in a two or three level house	Wealthy These families tend to own a nice house, private high quality transport, and have access to plentiful entertainment and food.
These families own most items necessary for a comfortable life. Some items are of high quality (expensive) and people tend to live in flat roof houses.	Comfortable These families have adequate, quality food, clothing, transport and home furniture though not all furniture pieces are expensive.
These families have enough food; they tend to have better quality meals (with meat, fish and eggs). They tend to own a range of necessary items that are not of high quality (inexpensive) and have new clothes every year. They tend to live in tile roof houses.	Basic needs Foods were not a matter of concern for these families. They typically have three or four good meals a week and can afford to own items for entertainment such as a TV. However, they could not afford adequate private transport.
These families lack food and their meals tend to be of low quality (no meat or fish). They are likely own very simple, basic and inexpensive items such as a thermos and clock. They tend to live in straw houses or tile roof houses.	Shortage Food was a matter of concern for these families; They tend to own very basic and inexpensive items such as a wall clock, a stand fan, and a cupboard, and live in tile roof houses. Poor These families tend to afford only one or two good meals a week and buy one set of new clothes each year. They owned very few possessions which were simple such as a thermos. They were likely to live in straw houses.

The five bands defined the progression along the continuum of economic status. This method of interpretation provided a more formal description of the underlying construct of economic status from the item and score point descriptions. It also enabled a comparison of the derived measure with the original hypothesised construct set out in Table 1. Table 5 illustrates the comparison of the two construct descriptions. The match was close despite the fact that there were five levels in the derived and four in the hypothesised variable. The fact that the content analysis "back translated" to the original hypothesised construct was further evidence of the construct validity of the scale (Griffin & Phan, 2001; Messick, 1989).

In summary, of the 16 items included in the questionnaire to measure the latent variable of wealth levels of Vietnamese students' families, one item was removed and the other 15 items were found to fit the model. These 15 items were also well separated along the continuum and clearly differentiated the families in terms of their wealth. There were five levels of economic status discernible among the people in the sample: " poor", "shortage", "basic need", "comfortable life", and "wealthy" (Nguyen & Griffin, 2004).

Conclusions and Implications

The method of constructing, calibrating and interpreting the Economic status index in rural Vietnam using Rasch modelling enabled the scale to distinguish between members of a relatively homogenous population in two communes in a rural district of Vietnam. Given the important association of economic status with other factors in the social sciences in general, and in education in particular, the measure of economic status in rural Vietnam can be a useful instrument and approach to the measurement of economic status of people in developing countries. The study also illustrated the advantages of item response theory in forming the measure. It should be noted that for urban populations and in future

studies, more expensive items may have to be included to match the differences in trend and the changes in prices of purchasing items. The scale has not been used with urban samples as was Griffin's (2005) scale, but it is unlikely that in remote rural Vietnam the items would change rapidly. Should there be a change in the possessions, the scale would need to be reformed, but this study has shown that possessions can define family wealth and provide a measure that differentiates between families.

References

Adams, R. J., & Khoo, S. T. (1996). Quest : The interactive test analysis system (Version 2.1) [Computer Software]. Camberwell, Vic.: Australian Council for Educational Research.

Anh, M. (2001). Motorbikes and solutions to traffic jams. *Giao Thong Van Tai*, *3*.

Behrman, J. R., & Deolalikar, A. B. (1990). The intrahousehold demand for nutrients inrural South India: Individual estimates, fixed effects, and permanent income. *Journal of Human Resources 25*(4), 665-696.

Bollen, K. A., Glanville, J. L., & Stecklov, G. (2001). Economic status proxies in studies of fertility in developing countries: Does the measure matter?. *Measure: Measure Evaluation,* 1-38.

Bollen, K. A., Glanville, J. L., & Stecklov, G. (2002). Economic status proxies in studies of fertility in developing countries: Does the measure matter?. *Population Studies – A Journal of Demography, 56,* 81–96.

Bond, T. G., & Fox, C. M., (2001). *Applying the Rasch model: Fundamental measurement in the human sciences*. Mahwah, NJ: Lawrence Erlbaum Associates.

Corcoran, B., McKenna, A., McDonald, M., Griffin, P., & Pitman, A. (1996). *Literacy networking at the CES/Provider/Employer Interface.* Department of Employment, Education, Training and Youth Affairs.

Deaton, A. (1992). *Understanding consumption*. New York: Oxford University Press.

Filmer, D., & Pritchett, L. (1998a). *Estimating wealth effects without expenditure data - or tears: An application to educational enrolments in states of India*. World Bank Policy Research Working Paper No. 1994, Washington.

Filmer, D., & Pritchett, L. (1998b*). The effect of household wealth on educational attainment around the world: Demographic and health survey evidence*. World Bank Policy Research Working Paper No. 1980, Washington.

Filmer, D., & Pritchett, L. (1999). The effect of household wealth on educational attainment: Evidence from 35 countries. *Population and Development Review 25*(1), 85-120.

Filmer, D., & Pritchett, L. (2001). Estimating wealth effects without income or expenditure data - or tears: Educational enrolment in India. *Demography 38*, 115-132.

Friedman, M. (1957). *A Theory of the consumption function*. Princeton: Princeton University Press.

Griffin, P. (1997). *An Introduction to the Rasch Model*. Melbourne: The University of Melbourne, Assessment Research Centre.

Griffin, P. (2004). Total test-score variable. An approach to the validity issue. A comment on Russell's zero-sum hypothesis. *Curriculum Inquiry 34*(3), 319-340.

Griffin, P. (2005). Developing a measure of wealth for primary student families in a developing country: Comparison of two methods of psychometric calibration. *Studies in Educational Evaluation, 31,* 195-206. .

Griffin, P., & Phan, A. (2001). Assessment of creative writing in Vietnamese primary education. Assessment Research Centre, The University of Melbourne Web site: http://www.edfac.unimelb.edu.au/LED/ARC.

Griffin, P., & Tran, K. (2000). *The World Bank project report on primary schools monitoring*. Ha Noi: Ministry of Education and Training.

Hambleton, R. K., Swaminathan, H., & Rogers, H. J. (1991). *Fundamentals of item response theory*. USA: SAGE Publications, Inc.

Hentschel, J., & Lanjouw, P. (1996). *Constructing an indicator of consumption for the analysis of poverty: Principles and illustrations with reference to ecuador*. Living Standards Measurement Study (Working Paper No. 124). Washington, DC: World Bank.

Linacre, J. M. (1998). Rasch first or factor first? *Rasch Measurement Transactions, 11*, 603.

Linacre, J. M., & Wright, B. D. (1994). Chi-square fit statistics. *Rasch Measurement Transactions, 8*(2), 350.

Messick, S. (1989). Validity. In R.L. Linn (Ed.), *Educational Measurement* (pp. 13-103). New York: Macmillan.

Montgomery, M. R., Gragnolati, M., Burke, K. A., & Paredes, E. (2000). Measuring living standards with proxy variables. *Demography, 37,* 155–174.

Nguyen, T. K. C. (2002). *Family and student influences on withdrawal from lower secondary school in rural Vietnam.* Unpublished doctoral dissertation, The

University of Melbourne.

Nguyen, T. K. C., & Griffin, P. (2003). *Measuring attitudes of Vietnamese parents and students to schooling*. Paper presented at the Annual Conference of the Australian Association for Research in Education, Auckland.

Nguyen, T. K. C., & Griffin, P. (2004). *Measuring economic status of students' families in rural Vietnam*. Paper presented at the Second International Rasch Conference: Measurement in Heath, Education, Psychology and Marketing; Development with Rasch models, Perth Western Australia.

Rasch, G. (1960). *Probabilistic model for some intelligence and attinment tests*. Chicago : MESA press.

Research Centre for Complementary Education. (1992). *Survey on Status and Causes of Illiteracy among Women and Girls in Vietnam.* Ha Noi, Vietnam.

Thurstone, L. L., & Chave, E. J. (1929). *The measurement of attitude*. Chicago: University of Chicago Press.

Tran, K. (1994). The situation of repetition and dropping out of students in general schools in Vietnam from 1981 to 1990. In K. Tran & T. T. Truong (Eds.), *National Project Reports on Dropping Out and Repetition* (pp. 1-10). Viet Nam: National Research Institute for Educational Sciences.

UNICEF (2004). *End of Decade Assessment - Multiple Indicator Cluster Surveys.* Web site: http://www.childinfo.org/MICS2/finques/M2finQ.htm.

Wright, B. D. (1996). Comparing Rasch measuremnt and factor analysis. *Structural Equation Modelling, 3,* 3-24.

Wright, B.D. (1997). A history of social science measurement. *Educational Measurement: Issues and Practice, 16*(4), 33-45.

Wright, B. D., & Masters, G. N. (1982). *Rating scale analysis*. Chicago: Mesa Press.

Received May 25, 2006
Revision received April 13, 2007
Accepted June 26, 2007